WMSD complaints among Palm Oil Plantation Workers: Impact of machine and technology usage

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Machines and technologies are the key for the paradigm shift in achieving sustainable agriculture development. The ergonomics design of the machines and technologies is very important to resolve WMSD problems faced by workers. The study aims to investigate on the pain problems experienced by palm oil workers on their body parts, due to the impact of the usage of machines and technologies as they perform their daily tasks in the palm oil plantation. A survey was conducted using Modified Nordic Questionnaire to investigate and analyse musculoskeletal symptoms among palm oil plantation workers. There were 12 palm oil plantation workers who participated in the survey. The survey results show that all workers who used machines and technologies while working have been experiencing body parts pain disorders, especially at the neck. Body parts pain experienced by these workers has led to an increasing number of palm oil plantation workers who are resisting from using machines and technologies.

Practitioner Summary: Machines and technologies would be very helpful tools, if the designers have considered various ergonomic factors at the design stage. This is important because a good and realistic relationship needs to be established between human user and machine. Human workers shall then be able to accept and continue to use the machines and technologies, if it is comfortable and safe to use.

Keywords: Machines Technology, WMSDs, Body Map Symptoms, Palm Oil Plantation

1. Introduction

For many developing countries, especially Malaysia, agriculture provides the main source of jobs and contributes significantly to national income (Jin et al., 2001; Basiron, 2007). However, there are still many countries that are experiencing low level agricultural productivity problems (Alam et al., 2010). Obviously, improving agricultural productivity is essential for the economic growth and development. One important way to help increasing the agricultural productivity is to make improvements and to produce more agricultural technology (Doss, 2006). In a rapidly growing globalization, the use of modern technology and machine in the agriculture industry is very helpful to raise farmers' living standards and thus, achieving the national goal (Thepent & Chamsing, 2009). A more systematic cultivation system in the agriculture industry can be increased with the introduction of new machines and technologies. It plays a significant role such as increasing the agriculture production by saving

time for the crop systems (Aunger, 2010). Labour costs can also be reduced by using machines and technologies as opposed to manual tools which necessitate more workers. Apart from helping to increase crop production, machines and technology can also provide better health benefits to workers. Therefore, by using machines and technology, workers no longer need to carry heavy loads or do a lot of movements.

The use of machines and technology in the palm oil industry is also highly necessary. Oil palm has become Malaysia's largest agriculture commodity and relevant parties are continuously working to improve the productivity advantages through technological development and innovation (Adebowale, 2008; Rasiah & Shahrin, 2006). This improvement is in line with the development of science and technology policy that seeks to improve the quality of agricultural products and help alleviate the burden on farmers (Gijsbers, 2009; Widana et al., 2012). Various types of machines that have been produced to assist workers in palm oil plantations include Cantas®, powered wheelbarrow and mechanical harvester (Jamil, 2008; Nawi *et al*., 2014). All of these technologies have been absorbed into oil palm plantations, but they are not comprehensively used. The majority of workers are still using manual tools (Ng *et al*., 2013; Norzan *et al*., 2014).

1.1 Manual tools, Machines Technology and Work-related Musculoskeletal Disorders (WMSDs)

Recently, there has been an increased use of manual tools among workers and it has resulted in work-related musculoskeletal disorder (WMSDs) problems becoming more serious. The current trend also indicates that WMSDs and the cost of compensation for this type of disease is increasing in many industries (Rappaport, 2003). This situation is also faced by palm oil plantation workers. The majority of the workers are still using manual or conventional tools in their daily work (Nawi *et al*., 2013; Ng *et al*., 2013; Norzan *et al*., 2014). Working conditions that require a lot of movements, such as pushing, pulling, walking, standing and heavy lifting can aggravate WMSD pain into becoming chronic among palm oil plantation workers (Ng *et al*., 2014). Despite the many high technology machines that have been produced, manual tools remain to be preferred for the workers. The majority of workers have rejected the use of machines and technology because of the fact that they are not ergonomically designed (Das, et al., 2013). If the workers continuously use them, it will be the precursor to their suffering from pain on their body parts and health problems in general (Jayaselan & Ismail, 2010). Thus, when workers rejected the technology produced, the usage of traditional tools will be back in order. Therefore, this preliminary study has been conducted to identify health issues as well as work-related musculoskeletal complaints among workers resulting from them using the machines and technology. The findings of the study can provide some useful insights on the ergonomic design of machines and technology.

2. **Methodology**

A cross-sectional survey was conducted to collect data using a Modified Nordic Questionnaire (Kuorinka et al., 1987). This study aims to find preliminary information on the use of machine tools technology among palm oil workers. The study was carried out among palm oil plantation workers,

who have used machine tools or who have experienced using them daily at work. Daily work refers to all the work that has to be done in the palm oil plantation, starting from harvesting fresh fruit to spraying pesticides and applying fertilizer. To answer the survey questionnaire, a selection of employees was done at random. Palm oil plantation workers need to answer the survey questionnaire, which contains demographic and body map symptoms questions. Later, oral interview sessions were conducted in order to get more in-depth subjective information, one which cannot be derived out of the survey questions.

3. **Result and Discussion**

A total of 12 respondents had participated in this preliminary study. All respondents were employees who use technology and machine tools while working in an oil palm plantation. Most of the workers are male between 20 and 30 years of age and are non-Malaysian citizens. The mean body height and body weight of the workers were 145cm and 50kg. In terms of the educational level, 50% of the respondents achieved education up to the primary school level, 33% obtained secondary education level and 17% did not go to any school. Out of 12 respondents, 42% of the respondents were smokers. The workers in the palm oil plantation worked for 10 hours per day, starting from 7am until 5pm with a 30 minutes' break for 2-3 times.

From the result of the study, machines and technology that have been used were collecting FFBs machines. The machines are the Mechanical Buffalo (Badang) and Mini Tractor Grabber (MTG). Out of 12 respondents, 5 respondents were using the Badang machine and another 7 respondents had used the MTG machine. Both of these machines were operated to help workers collect fresh fruit bunches (FFBs) that were cut by the fruit cutters. Therefore, the workers do not need to use conventional tools, like the wheelbarrow. The workers will drive the machine technology, moving from tree to tree to collect FFBs on the ground.

(a) (b)

Figure 1. Types of machines and technology (a) Mini Tractor Grabber (MTG) and (b) Mechanical Buffalo (Badang).

Body Pain Symptoms

Results of this survey have shown that the respondents who use these machines and technology often suffer from body pain. Table 1 shows the total percentage of respondents who suffered from body pain and the frequency in pain (either sometimes or frequently). The most commonly affected body region among respondents was neck pain (100%) followed by left shoulder (92%),lower arm (92%), left hip (92%), right elbow (83%), lower back (83%), right ankle (75%), left thigh (67%), right shoulder (67%), upper arm left (67%), lower arm left (58%), right fingers (58%), calf (58%), left knee (58%), right feet (58%), right hip (50%), right wrist (50%), left ankle (50%), left elbow (42%), upper back (42%), left wrist (42%), right thigh (42%), right knee (42%), left feet (42%), right upper arm (33%) and left fingers (33%). These findings are consistent with a study conducted by Hashim & Taha (2012), which reported high prevalence of WMDSs among palm oil plantation workers.

Based on authors' observations and oral interviews, in the palm oil plantation, the high percentage of neck pain sufferers among the workers could be due to the job and machine conditions. As an example, workers who drive the MTG machine always have to turn their heads every time they want to pick up FFBs from the ground and put them into the machine cart. They also need to control backhoe loaders of the machine to make sure that the FFBs fall directly into the cart. This repeated neck movements can cause the workers to suffer from neck pain.

Table 1. Body pain of palm oil workers caused by their activity of using of machines and technology in daily work

Body parts	**In pain**		**Frequency of pain**	
	Total (n)	%	Sometimes (n)	Frequent (n)
Neck	12	100 %	9	3
Shoulder(right)	8	67 %	6	2
Shoulder (left)	11	92 %	10	1
Elbow (right)	10	83 %	5	5
Elbow (left)	5	42 %	5	0
Upper arm (right)	4	33 %	0	4
Upper arm (left)	8	67 %	7	1
Lower arm (right)	11	92 %	7	4
Lower arm (left)	7	58 %	7	0
Upper back	5	42 %	5	0
Lower back	10	83 %	2	8
Hip (right)	6	50 %	5	1
Hip (left)	11	92 %	11	0
Wrist (right)	6	50 %	5	1
Wrist (left)	5	42 %	5	0
Fingers (right)	7	58 %	4	3

Fingers (left)	4	33 %	4	0
Thigh (right)	5	42 %	5	0
Thigh (left)	8	67 %	8	0
Calf (right)	7	58 %	7	0
Calf (left)	7	58 %	7	0
Knee (right)	5	42 %	5	0
Knee (left)	7	58 %	7	0
Ankle (right)	9	75 %	8	1
Ankle (left)	6	50 %	6	0
Feet (right)	7	58 %	5	2
Feet (left)	5	42 %	4	1

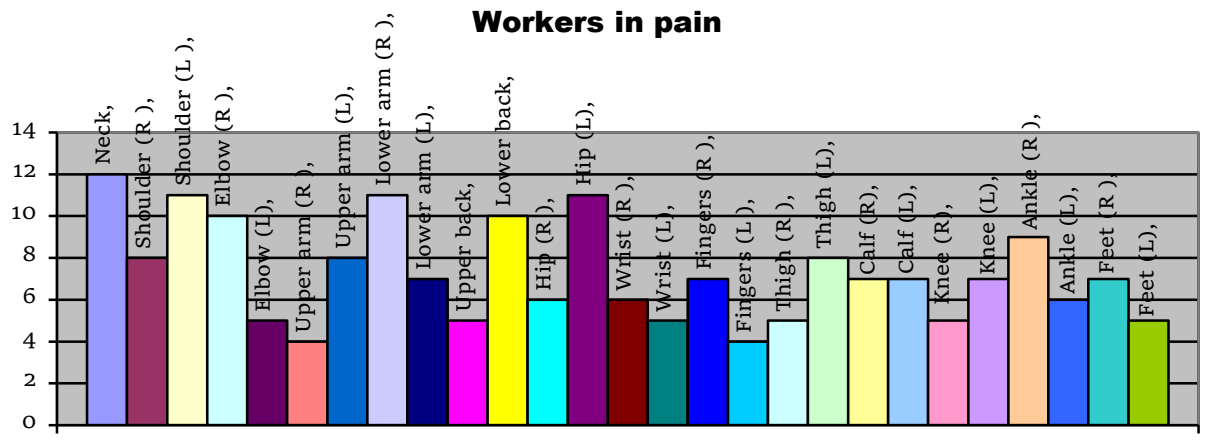

Figure 2. Bar chart of body pain-related complaints among palm oil plantation workers, who use the machine technology in their daily work.

Referring to Figure 2, it is clear that the workers have body pain problems on all parts of their bodies. However, the frequency of pain experience tends to fluctuate (refer to Figure 3). The majority of workers were at moderate pain level or would feel in pain at times. From the 12 respondents, body parts which are reported to be frequently in pain were lower back (8), right elbow (5), right lower arm (4), right upper arm (4), neck (3), right fingers (3), right shoulder (2), right feet (2), left shoulder (1), left upper arm (1), right hip (1), right wrist (1), right ankle (1) and left feet (1). High frequency of bending forward was believed to be the predictor of back pain. Although workers use machines and technology, they still have to move a lot, such as walking, standing and bending.

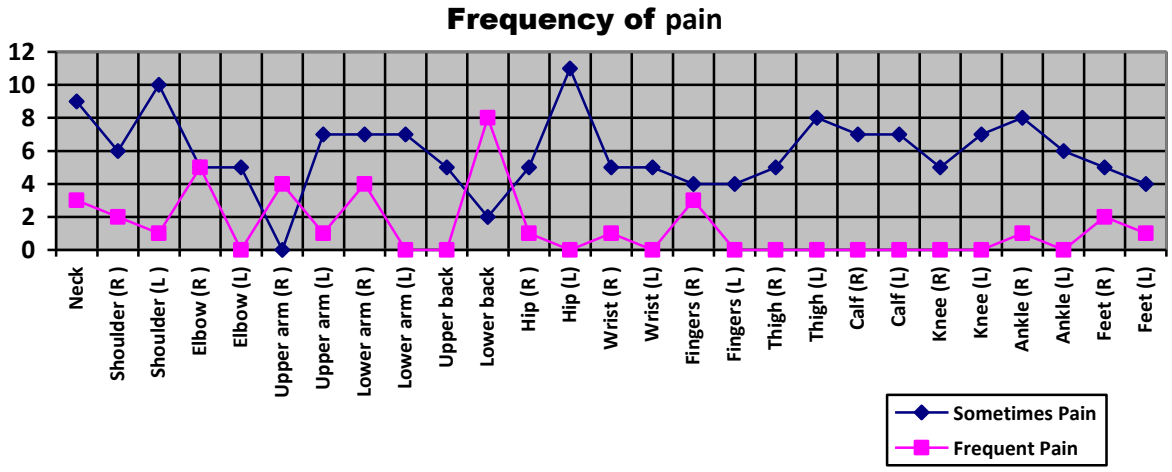

Figure 3. Graph chart number of workers who are in pain, referring to the body parts.

Referring to Figures 2 and 3, based on the findings of the study, it can be concluded that overall, WMSDs were very common among palm oil plantation workers. The respondents admitted that the pain was caused by their daily working activities. They have gone for some medical treatment, but the pain still persists. Even though the machines and technology can help lighten the burden on workers, unfortunately and ironically, they can also adversely affect the workers' health. This finding is in line with a study by Yadav et. al. (2007), which states that machines and technology demonstrate various problems, including their non-ergonomic design, that may affect the workers' safety and health. In addition, Hashim & Taha (2012) also suggested applying principles of ergonomics in equipment designs to prevent ergonomic-related problems and WMSDs.

4. Conclusion

From the study, it is found that the high prevalence of WMSDs in order of severity is the neck, shoulder, arm and hip, respectively. In other words, machines and technology have a negative impact on workers' health. This results in the rejection of machine and technology usage among workers. Therefore, proactive changes need to be made in the development of new machines and technology especially for usage in the palm oil plantation. An ergonomic design will contribute towards a more comfortable and safer working environment. Subsequently, WMSD problems will be reduced and work productivity will be increased.

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